Learning

Chapter 5

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Chapter 5 Learning Objective Menu

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What is Learning?

- Learning – any relatively permanent change in behavior brought about by experience or practice.
  - When people learn anything, some part of their brain is physically changed to record what they have learned.
  - Any kind of change in the way an organism *behaves* is learning.

An instantaneous learning experience.

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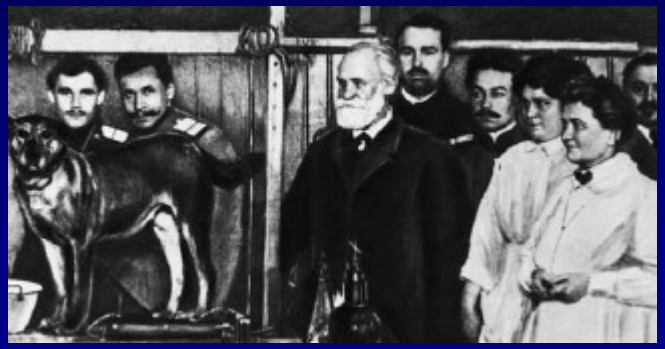
Pavlov and Classical Conditioning

- Ivan Pavlov – Russian physiologist (person who studies the workings of the body) who discovered classical conditioning through his work on digestion in dogs.



- Classical conditioning - learning to make a reflex response to a stimulus other than the original, natural stimulus that normally produces the reflex.

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Classical Conditioning Concepts

- Unconditioned stimulus (UCS) - a naturally occurring stimulus that leads to an involuntary response.
  - Unconditioned means "unlearned" or "naturally occurring."
- Unconditioned response (UCR) - an involuntary response to a naturally occurring or unconditioned stimulus.

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Classical Conditioning Concepts

- Conditioned stimulus (CS) - stimulus that becomes able to produce a learned reflex respons by being paired with the original unconditioned stimulus.
  - Conditioned means "learned."
  - A neutral stimulus can become a conditioned stimulus when paired with an unconditioned stimulus.
- Conditioned response (CR) - learned reflex response to a conditioned stimulus.
  - Sometimes called a conditioned reflex.

CS – ice cream truck

CR – salivation when hear ice cream truck bell

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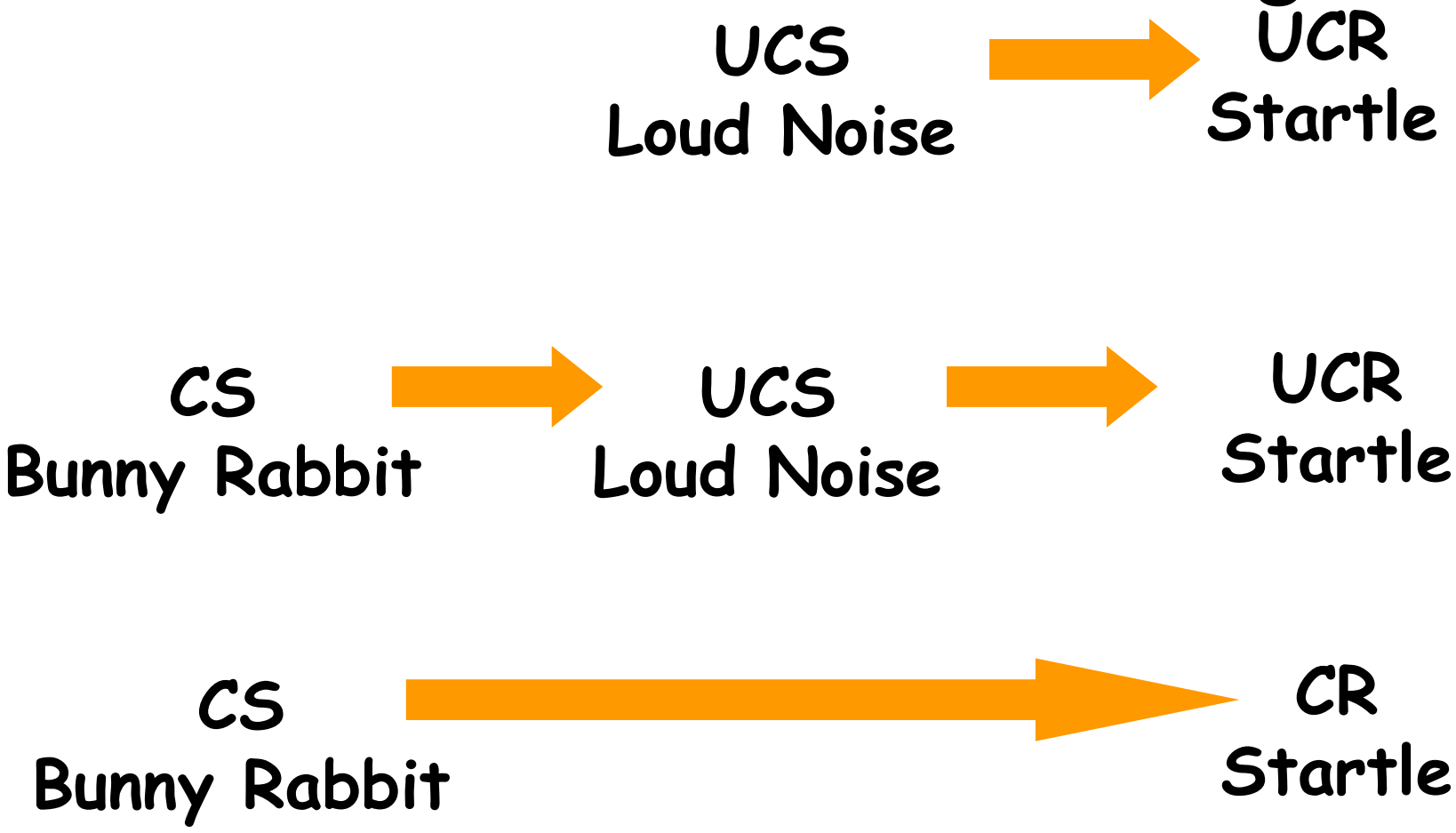
Classical Conditioning



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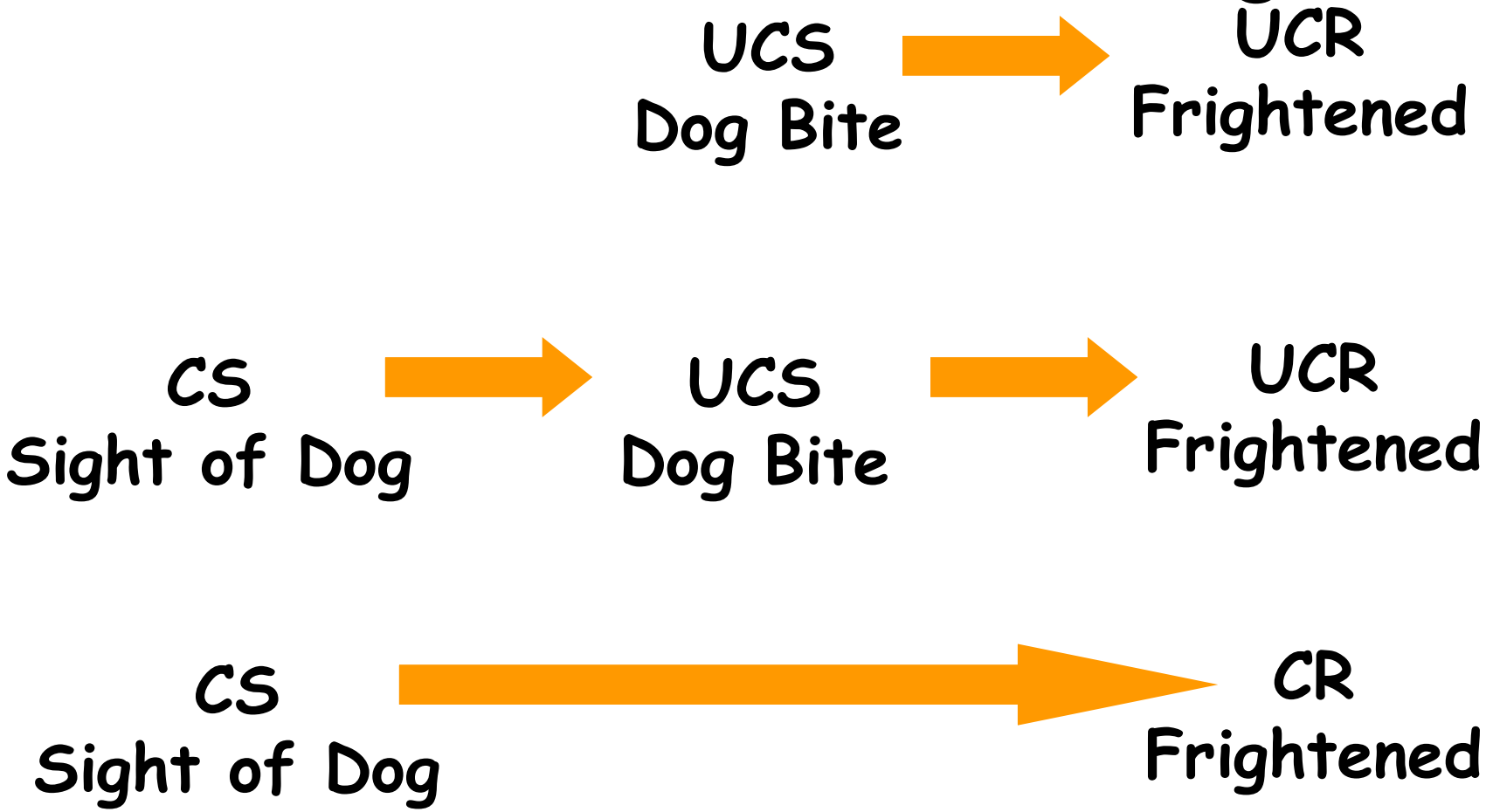
Classical Conditioning



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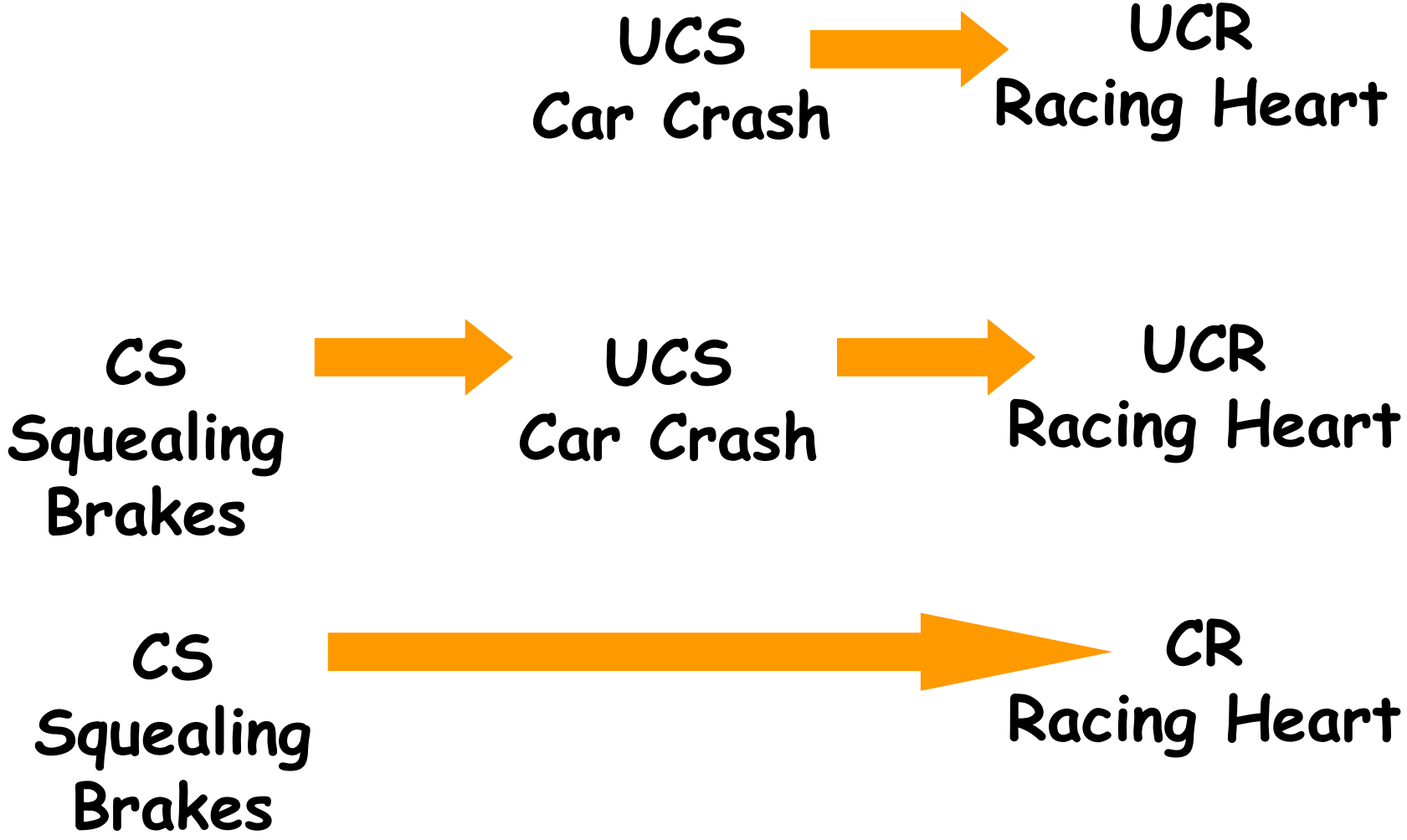
Classical Conditioning



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Classical Conditioning

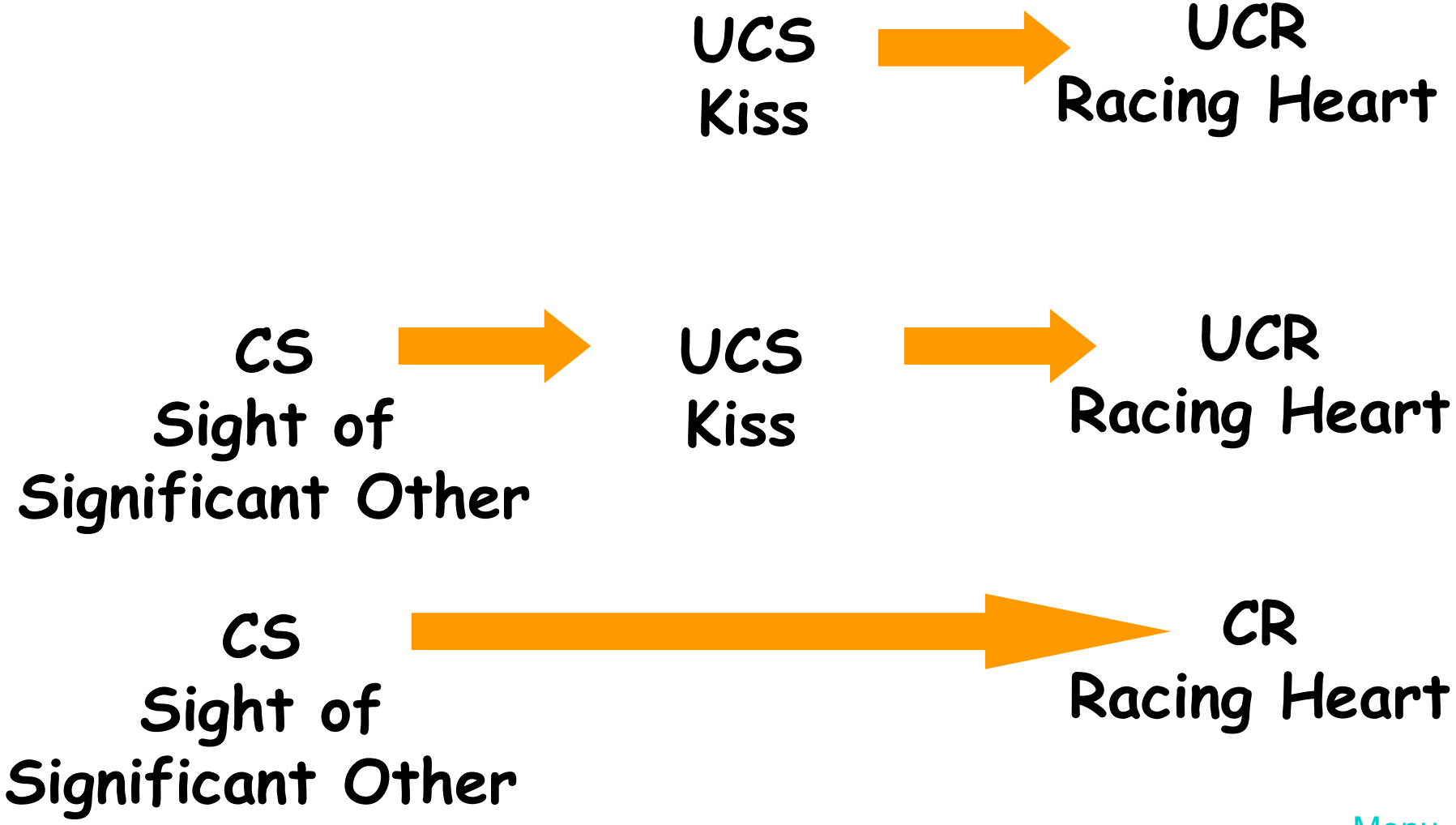

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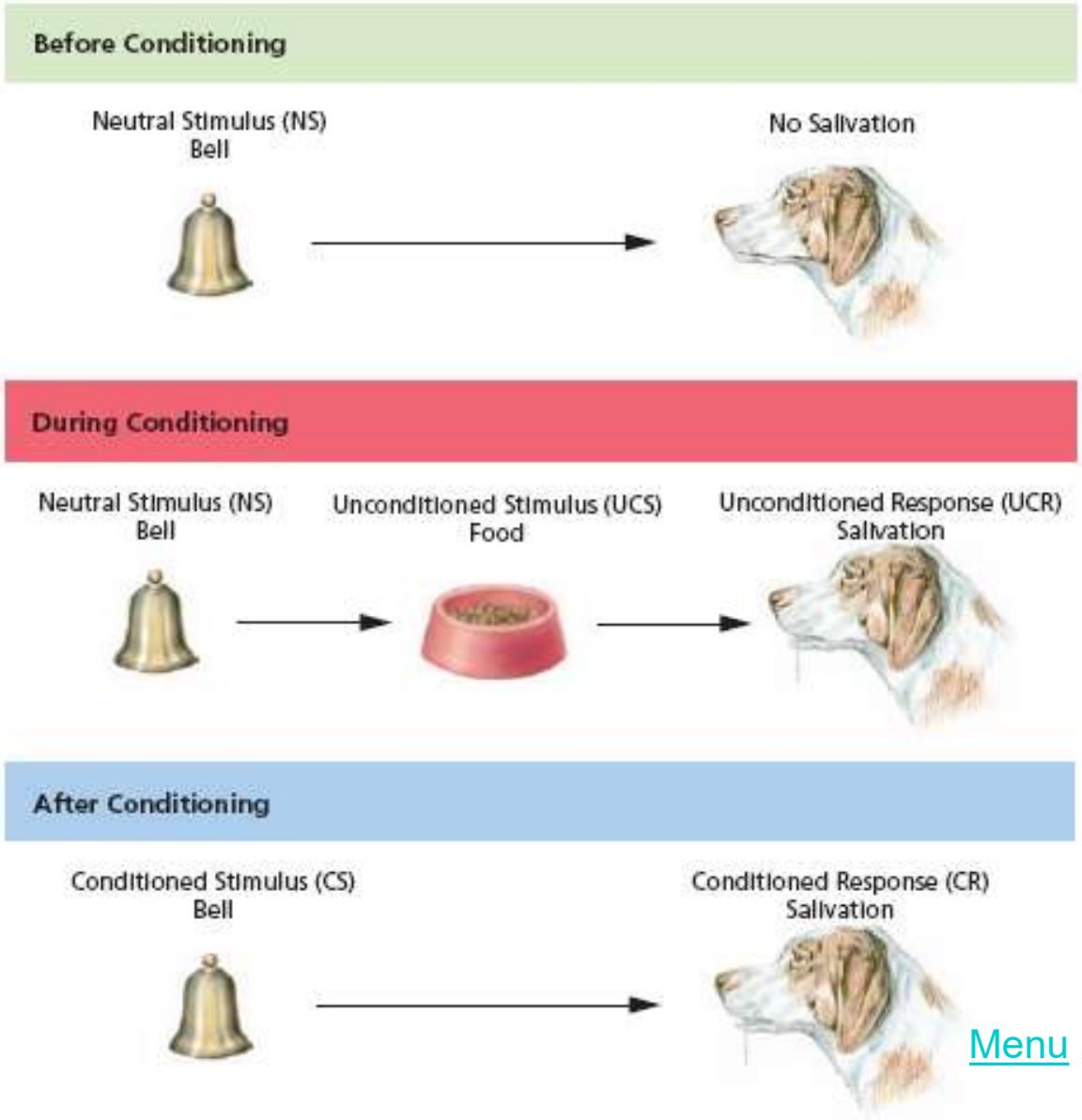
FIGURE 5.1 **Classical Conditioning**
Before conditioning takes place, the sound of the bell does not cause salivation and is a neutral stimulus, or NS. During conditioning, the sound of the bell occurs just before the presentation of the food (the UCS). The food causes salivation, the UCR. When conditioning has occurred after several pairings of the bell with the food, the bell will begin to elicit a salivation response from the dog without any food. This is learning, and the sound of the bell is now a CS and the salivation to the bell is the CR.

LO 5.4 Pavlov's classic experiment in conditioning



Acquisition - the repeated pairing of the NS and the UCS;
the organism is in the process of acquiring learning.

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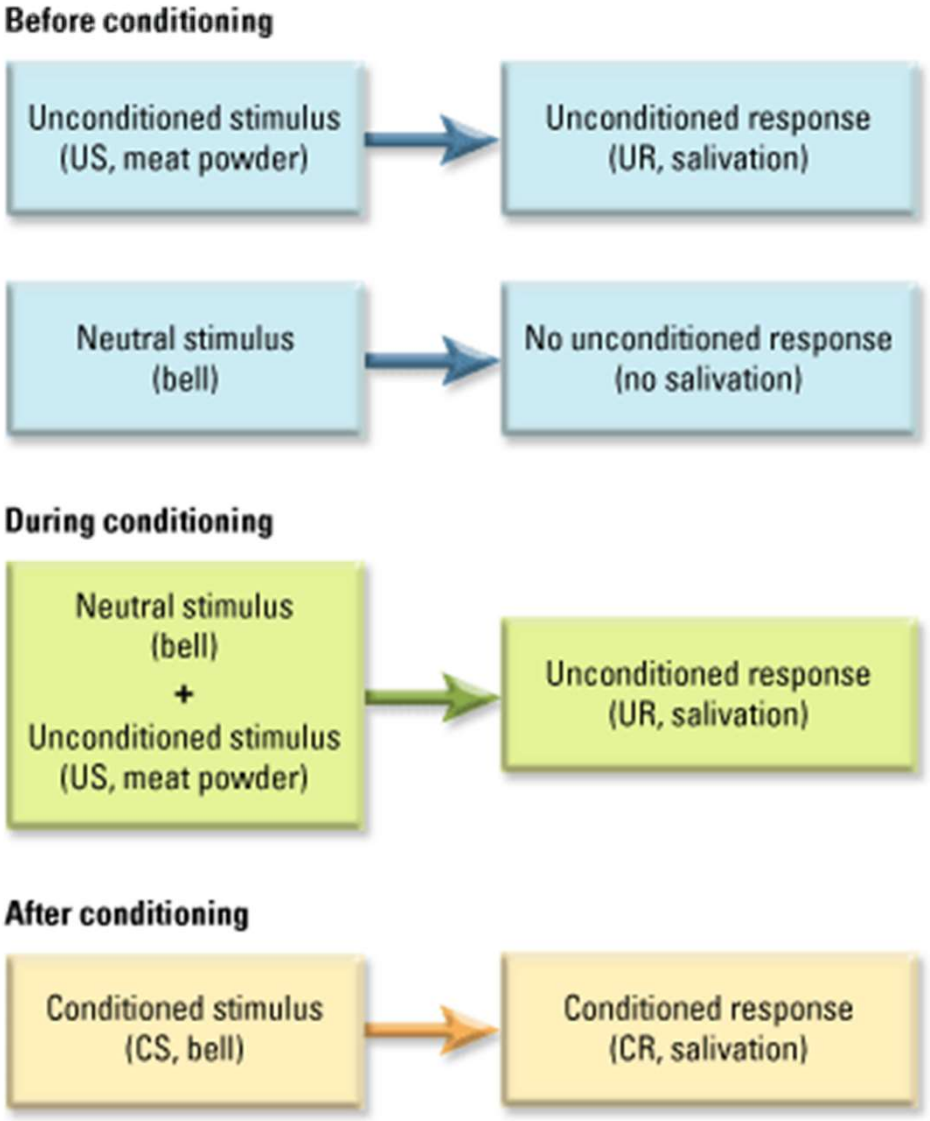
LO 5.4 Pavlov's classic experiment in conditioning



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Classical Conditioning Concepts

Although classical conditioning happens quite easily, there are a few basic principles that researchers have discovered:

1. The CS must come *before* the UCS.
2. The CS and UCS must come very close together in time—ideally, only several seconds apart.
3. The neutral stimulus must be paired with the UCS several times, often many times, before conditioning can take place.
4. The CS is usually some stimulus that is distinctive or stands out from other competing stimuli.

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Classical Conditioning Concepts

- Stimulus generalization - the tendency to respond to a stimulus that is only similar to the original conditioned stimulus with the conditioned response.
- Stimulus discrimination - the tendency to stop making a generalized response to a stimulus that is similar to the original conditioned stimulus because the similar stimulus is never paired with the unconditioned stimulus.
- Extinction - the disappearance or weakening of a learned response following the removal or absence of the unconditioned stimulus (in classical conditioning) or the removal of a reinforcer (in operant conditioning).

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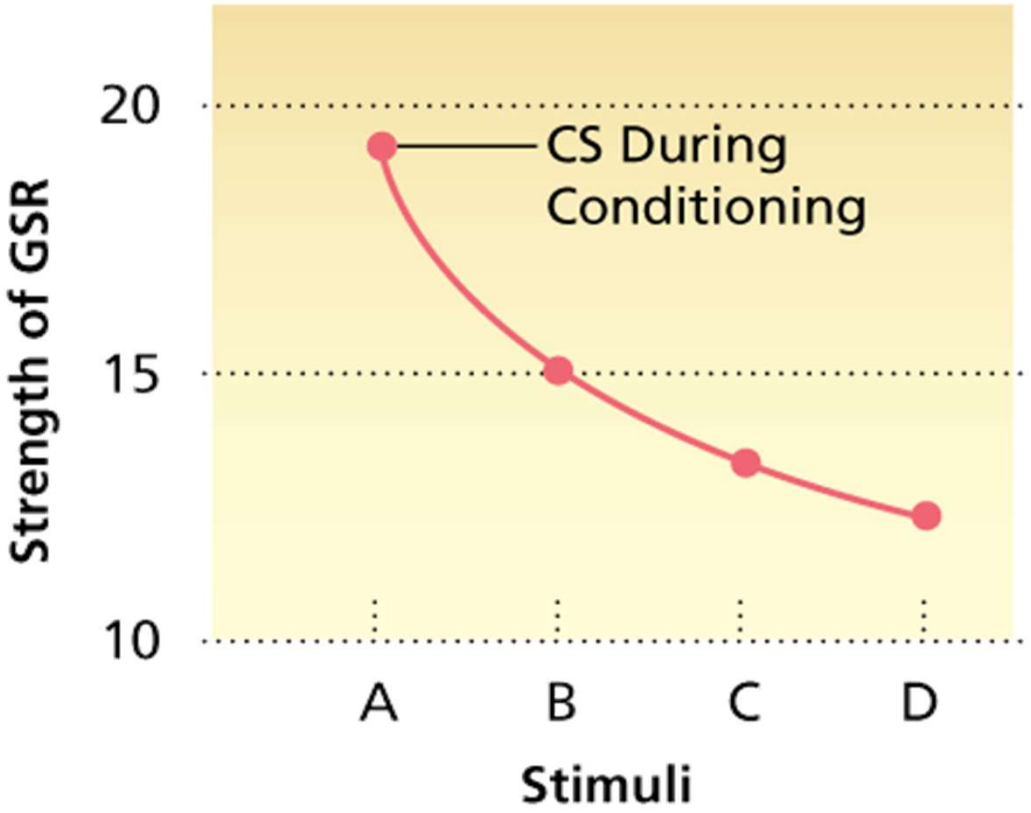
FIGURE 5.2 **Strength of the Generalized Response** An example of generalization. The subjects had been conditioned originally to a CS (A) of a given frequency. When tested with the original tone, and with tones B, C, and D of differing frequencies, a clear generalization gradient appeared. The closer the frequency of the test tone to the frequency of tone A, the greater was the magnitude of the response to the tone. (Howland, 1937)

LO 5.4 Pavlov's classic experiment in conditioning



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Classical Conditioning Concepts

- Reinforcer - any event or object that, when following a response, increases the likelihood of that response occurring again.
- Spontaneous recovery – the reappearance of a learned response after extinction has occurred.
  - *Learning is a relatively permanent change in behavior.*
- Higher-order conditioning - occurs when a strong conditioned stimulus is paired with a neutral stimulus, causing the neutral stimulus to become a second conditioned stimulus.

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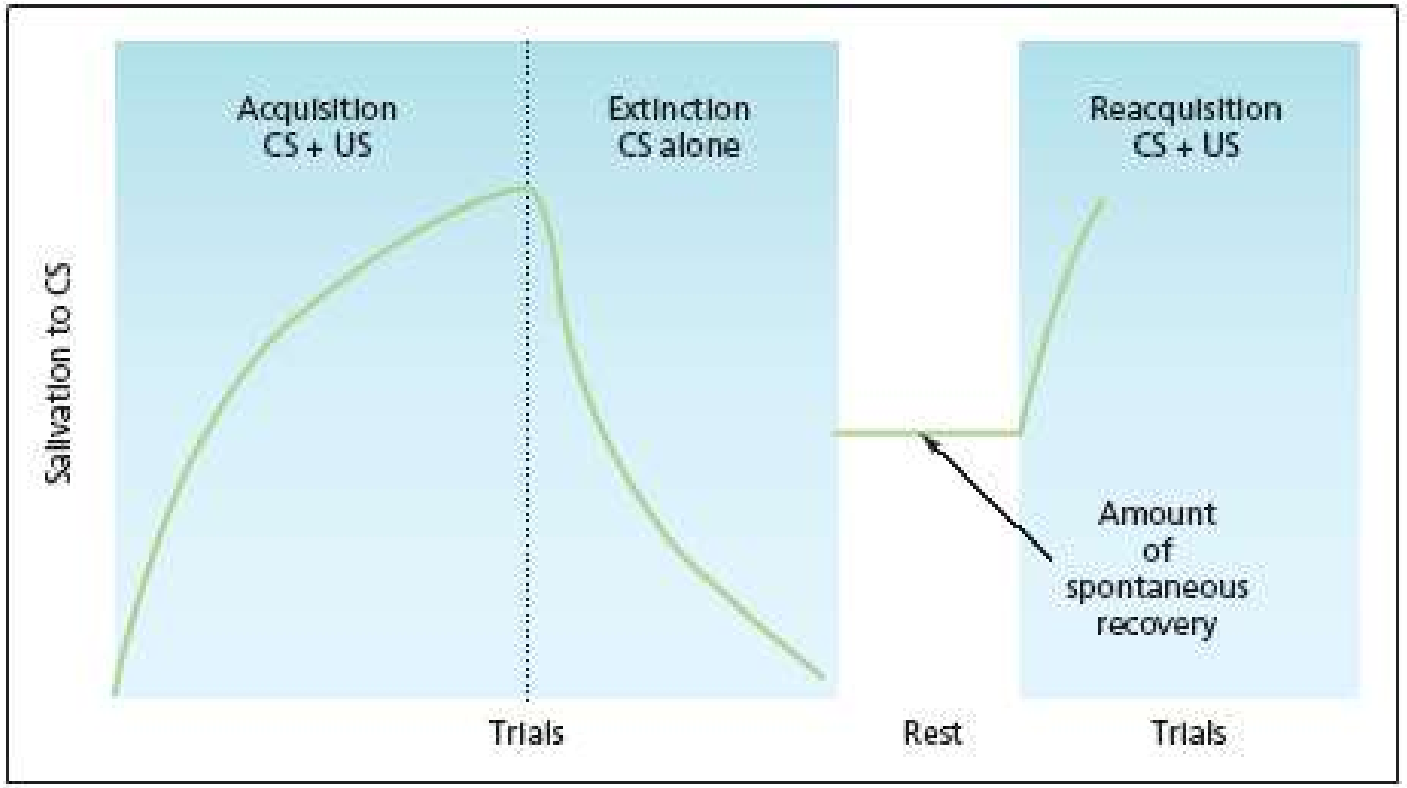
FIGURE 5.3 **Extinction and Spontaneous Recovery** The acquisition, extinction, spontaneous recovery, and reacquisition of a conditioned salivary response. Typically, the measure of conditioning is the number of drops of saliva elicited by the CS on each trial. Note that on the day following extinction, the first presentation of the CS elicits quite a large response.

LO 5.4 Pavlov's classic experiment in conditioning



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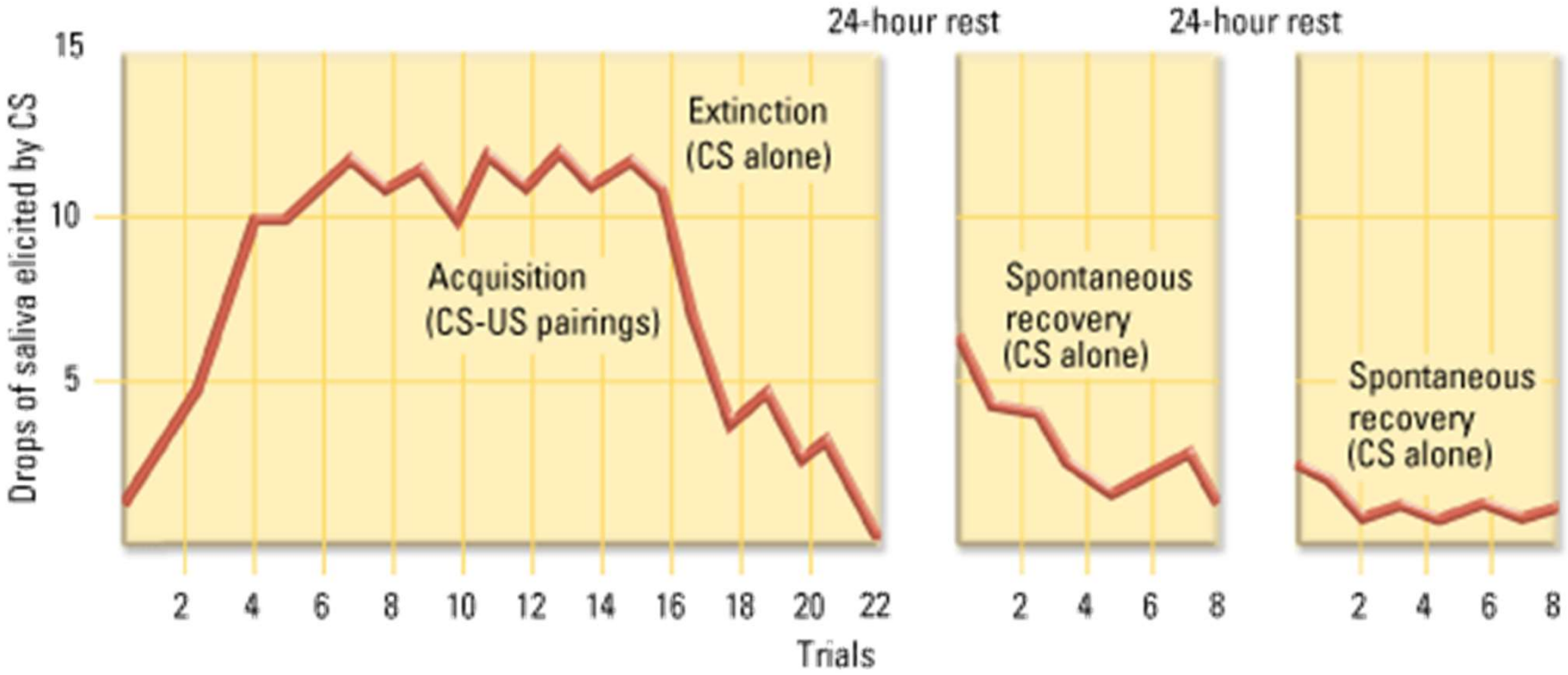
LO 5.4 Pavlov's classic experiment in conditioning



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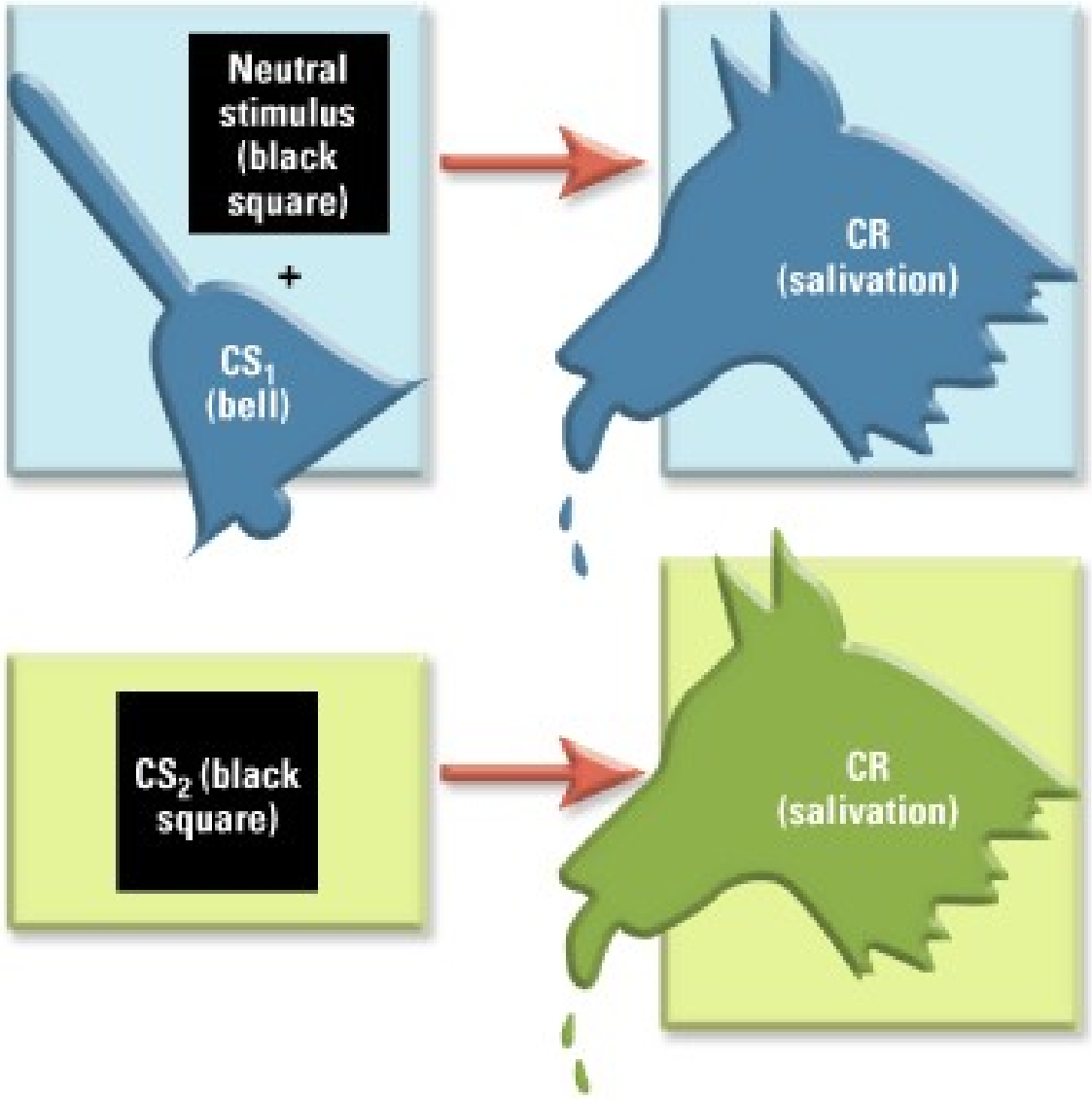
Higher order conditioning.



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Conditioned Emotional Response

- Conditioned emotional response (CER) - emotional response that has become classically conditioned to occur to learned stimuli, such as a fear of dogs or the emotional reaction that occurs when seeing an attractive person.
  - CERs may lead to phobias – irrational fear responses.

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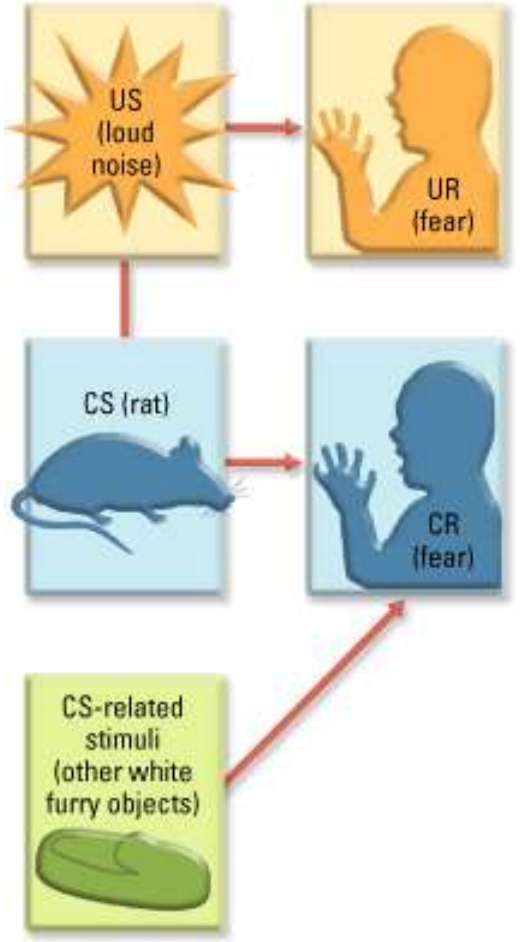
LO 5.5 Conditioned emotional response

FIGURE 5.4 **Conditioning of "Little Albert"** After Little Albert had been conditioned to fear a white rat, he became afraid of anything white and fuzzy, including John Watson himself with a white fuzzy mask on his face. Can you think of any emotional reactions you experience that might be classically conditioned emotional responses?



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Taste Aversion

- Vicarious conditioning - classical conditioning of a reflex response or emotion by watching the reaction of another person.
- Conditioned taste aversion - development of a nausea or aversive response to a particular taste because that taste was followed by a nausea reaction, occurring after only one association.

- Biological preparedness - the tendency of animals to learn certain associations, such as taste and nausea, with only one or few pairings due to the survival value of the learning.

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Why Classical Conditioning Works

- Stimulus substitution - original theory in which Pavlov stated that classical conditioning occurred because the conditioned stimulus became a substitute for the unconditioned stimulus by being paired closely together.
- Cognitive perspective - modern theory in which classical conditioning is seen to occur because the conditioned stimulus provides information or an expectancy about the coming of the unconditioned stimulus.

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Operant Conditioning

- Operant conditioning - the learning of *voluntary* behavior through the effects of pleasant and unpleasant consequences to responses.
- Thorndike's Law of Effect - law stating that if a response is followed by a pleasurable consequence, it will tend to be repeated, and if followed by an unpleasant consequence, it will tend not to be repeated.

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LO 5.7 Operant conditioning and Thorndike's law of effect

FIGURE 5.5 **Thorndike puzzle box**
A typical Thorndike puzzle box. The cat is placed inside the box and can get out by pushing on the little platform to one side of the door—at first, accidentally. Each time the cat managed to escape, it would be put back into the box until, through trial and error, it knew to push on the platform to open the door.

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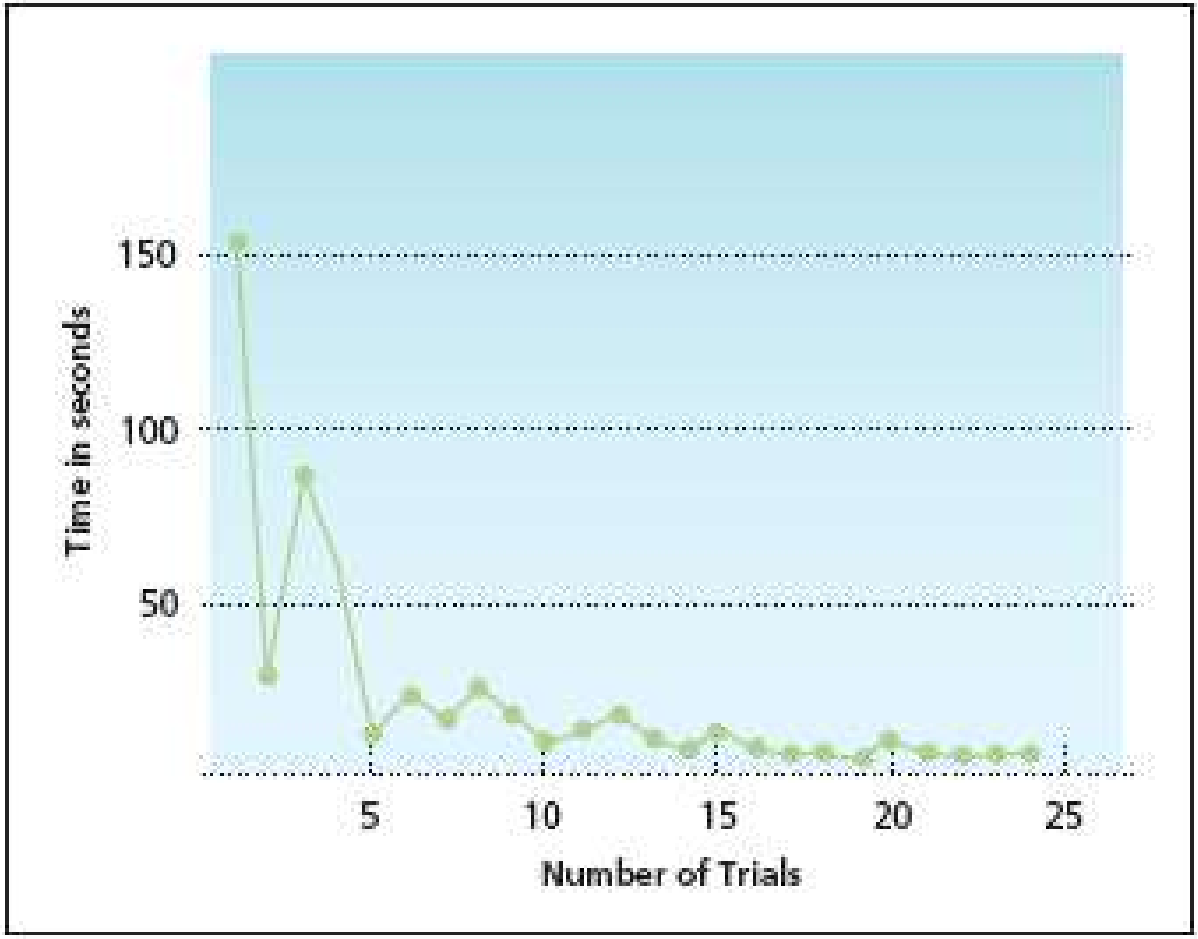
5.7 Operant conditioning and Thorndike's law of effect

FIGURE 5.6 **Graph of the Time to Learn in Thorndike's Experiment** This is one of the earliest "learning curves" in the history of the experimental study of conditioning. The time required by one of Thorndike's cats to escape from the puzzle box gradually decreased with trials but with obvious reversals.



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Skinner's Contribution

- Behaviorist; wanted to study only observable, measurable behavior.
- Gave "operant conditioning" its name.
  - Operant - any behavior that is voluntary.
- Learning depends on what happens *after* the response — the consequence.

"Once it became clear to me that, by responding correctly to certain stimuli, I could get all the bananas I wanted, getting this job was a pushover."

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5.8 Skinner's contribution to operant conditioning

FIGURE 5.7 **A Typical Skinner Box** This rat is learning to press the bar in the wall of the cage in order to get food (delivered a few pellets at a time in the food trough on lower left). In some cases, the light on the top left might be turned on to indicate that pressing the bar will lead to food, or to warn of an impending shock delivered by the grate on the floor of the cage.

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Reinforcement

- Reinforcement - any event or stimulus, that when following a response, increases the probability that the response will occur again.
  - Primary reinforcer - any reinforcer that is naturally reinforcing by meeting a basic biological need, such as hunger, thirst, or touch.
  - Secondary reinforcer - any reinforcer that becomes reinforcing after being paired with a primary reinforcer, such as praise, tokens, or gold stars.

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Positive and Negative Reinforcement

- Positive reinforcement - the reinforcement of a response by the addition or experiencing of a pleasurable stimulus.
- Negative reinforcement - the reinforcement of a response by the removal, escape from, or avoidance of an unpleasant stimulus.

Example: Taking aspirin for a headache is negatively reinforced – removal of headache!

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Shaping

- Shaping - the reinforcement of simple steps in behavior that lead to a desired, more complex behavior.
  - Successive approximations - small steps in behavior, one after the other, that lead to a particular goal behavior.

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Other Classical Conditioning Concepts

- Extinction – occurs if the behavior (response) is not reinforced.
- Operantly conditioned responses also can be generalized to stimuli that are only similar to the original stimulus.
- Spotaneous recovery (reoccurrence of a once extinguished response) also happens in operant conditioning.

One way to deal with a child's temper tantrum is to ignore it. The lack of reinforcement for the tantrum behavior will eventually result in extinction.

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LO 5.9 Important concepts in operant conditioning

TABLE 5.1 COMPARING TWO KINDS OF CONDITIONING

Operant Conditioning	Classical Conditioning
Goal is to increase the rate of an already occurring response.	Goal is to create a new response to a stimulus that doesn't normally produce that response.
Responses are voluntary.	Responses are involuntary and reflexive.
Consequences are important in forming an association.	Antecedent stimuli are important in forming an association.
Reinforcement must be immediate.	CS must occur immediately before the UCS.
An expectancy develops for reinforcement to follow a correct response.	An expectancy develops for UCS to follow CS.

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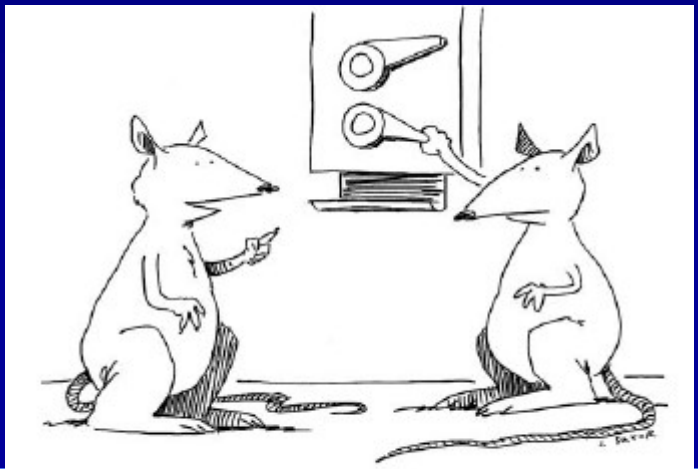
Schedules of Reinforcement

- Partial reinforcement effect - the tendency for a response that is reinforced after some, but not all, correct responses to be very resistant to extinction.
- Continuous reinforcement - the reinforcement of each and every correct response.



"Remember, every time he gives you a pellet, reinforce that behavior by pulling the lever."

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Schedules of Reinforcement

- Fixed ratio schedule of reinforcement - schedule of reinforcement in which the number of responses required for reinforcement is always the same.
- Variable ratio schedule of reinforcement - schedule of reinforcement in which the number of responses required for reinforcement is different for each trial or event.

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Schedules of Reinforcement

- Fixed interval schedule - of reinforcement schedule of reinforcement in which the interval of time that must pass before reinforcement becomes possible is always the same.
- Variable interval schedule of reinforcement - schedule of reinforcement in which the interval of time that must pass before reinforcement becomes possible is different for each trial or event.

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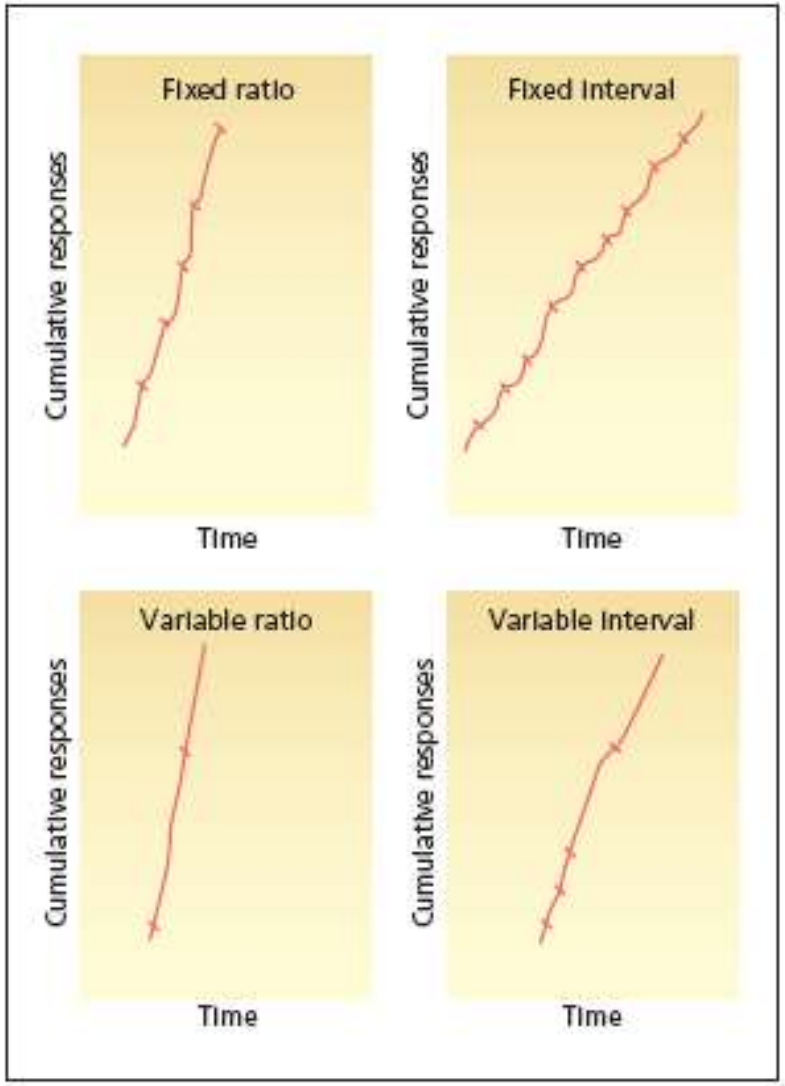
LO 5.10 Schedules of reinforcement

FIGURE 5.8 **Schedules of Reinforcement** The typical outcomes of four partial reinforcement schedules in the form of cumulative records. Slash mark indicates delivery of reinforcement. The pause after each reinforcement is very characteristic of fixed-ratio schedules, whereas the "scalloped" shape of the record is typical of fixed-interval schedules.



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Punishment

- Punishment - any event or object that, when following a response, makes that response less likely to happen again.
- Punishment by application - the punishment of a response by the addition or experiencing of an unpleasant stimulus.
- Punishment by removal - the punishment of a response by the removal of a pleasurable stimulus.

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LO 5.11 How punishment affects behavior

TABLE 5.2 NEGATIVE REINFORCEMENT VERSUS PUNISHMENT BY REMOVAL

Example of Negative Reinforcement	Example of Punishment by Removal
Stopping at a red light to avoid getting in an accident.	Losing the privilege of driving because you got into too many accidents.
Mailing an income tax return by April 15 to avoid paying a penalty.	Having to lose some of your money to pay the penalty for late tax filing.
Obeying a parent before the parent reaches the count of "three" to avoid getting a scolding.	Being "grounded" (losing your freedom) because of disobedience.

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LO 5.11 How punishment affects behavior

TABLE 5.3 FOUR WAYS TO MODIFY BEHAVIOR

	Reinforcement	Punishment
POSITIVE (Adding)	Something valued or desirable; *Positive Reinforcement* Example: getting a gold star for good behavior in school	Something unpleasant; *Punishment by Application* Example: getting a spanking for disobeying
NEGATIVE (Removing/ Avoiding)	Something unpleasant; *Negative Reinforcement* Example: avoiding a ticket by stopping at a red light	Something valued or desirable; *Punishment by Removal* Example: losing a privilege such as going out with friends

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How to Make Punishment More Effective

1. Punishment should immediately follow the behavior it is meant to punish.
2. Punishment should be consistent.
3. Punishment of the wrong behavior should be paired, whenever possible, with reinforcement of the right behavior.

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Operant Stimuli and Stimulus Control

- Discriminative stimulus - any stimulus, such as a stop sign or a doorknob, that provides the organism with a cue for making a certain response in order to obtain reinforcement.

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Behavior Resistant to Conditioning

- Instinctive drift - tendency for an animal's behavior to revert to genetically controlled patterns.
  - Each animal comes into the world (and the laboratory) with certain genetically determined instinctive patterns of behavior already in place.
  - These instincts differ from species to species.
  - There are some responses that simply cannot be trained into an animal regardless of conditioning.

Raccoons commonly dunk their food in and out of water before eating. This "washing" behavior is controlled by instinct and difficult to change even using operant techniques.

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Behavior Modification

- Behavior modification - the use of operant conditioning techniques to bring about desired changes in behavior.
- Token economy - type of behavior modification in which desired behavior is rewarded with tokens.
- Time-out - a form of mild punishment by removal in which a misbehaving animal, child, or adult is placed in a special area away from the attention of others.
  - Essentially, the organism is being “removed” from any possibility of positive reinforcement in the form of attention.
- Applied behavior analysis (ABA) – modern term for a form of behavior modification that uses shaping techniques to mold a desired behavior or response.

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Biofeedback and Neurofeedback

- Biofeedback- the use of feedback about biological conditions to bring involuntary responses such as blood pressure and relaxation under voluntary control.
- Neurofeedback - form of biofeedback using brainscanning devices to provide feedback about brain activity in an effort to modify behavior.

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Cognitive Learning Theory

- Early days of learning – focus was on behavior.
- 1950s and more intensely in the 1960s, many psychologists were becoming aware that *cognition*, the mental events that take place inside a person's mind while behaving, could no longer be ignored.
- Edward Tolman – early cognitive scientist.

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Latent Learning

- Edward Tolman's best-known experiments in learning involved teaching three groups of rats the same maze, one at a time (Tolman & Honzik, 1930).
  - Group 1 – rewarded each time at end of maze.
    - Learned maze quickly.
  - Group 2 – in maze every day; only rewarded on 10th day.
    - Demonstrated learning of maze almost immediately after receiving reward.
  - Group 3 – never rewarded.
    - Did not learn maze well.
- Latent learning - learning that remains hidden until its application becomes useful.

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FIGURE 5.9 **A Typical Maze** This is an example of a maze such as the one used in Tolman's experiments in latent learning. A rat is placed in the start box. The trial is over when the rat gets to the end box.

LO 5.17 Tolman's classic study on latent learning

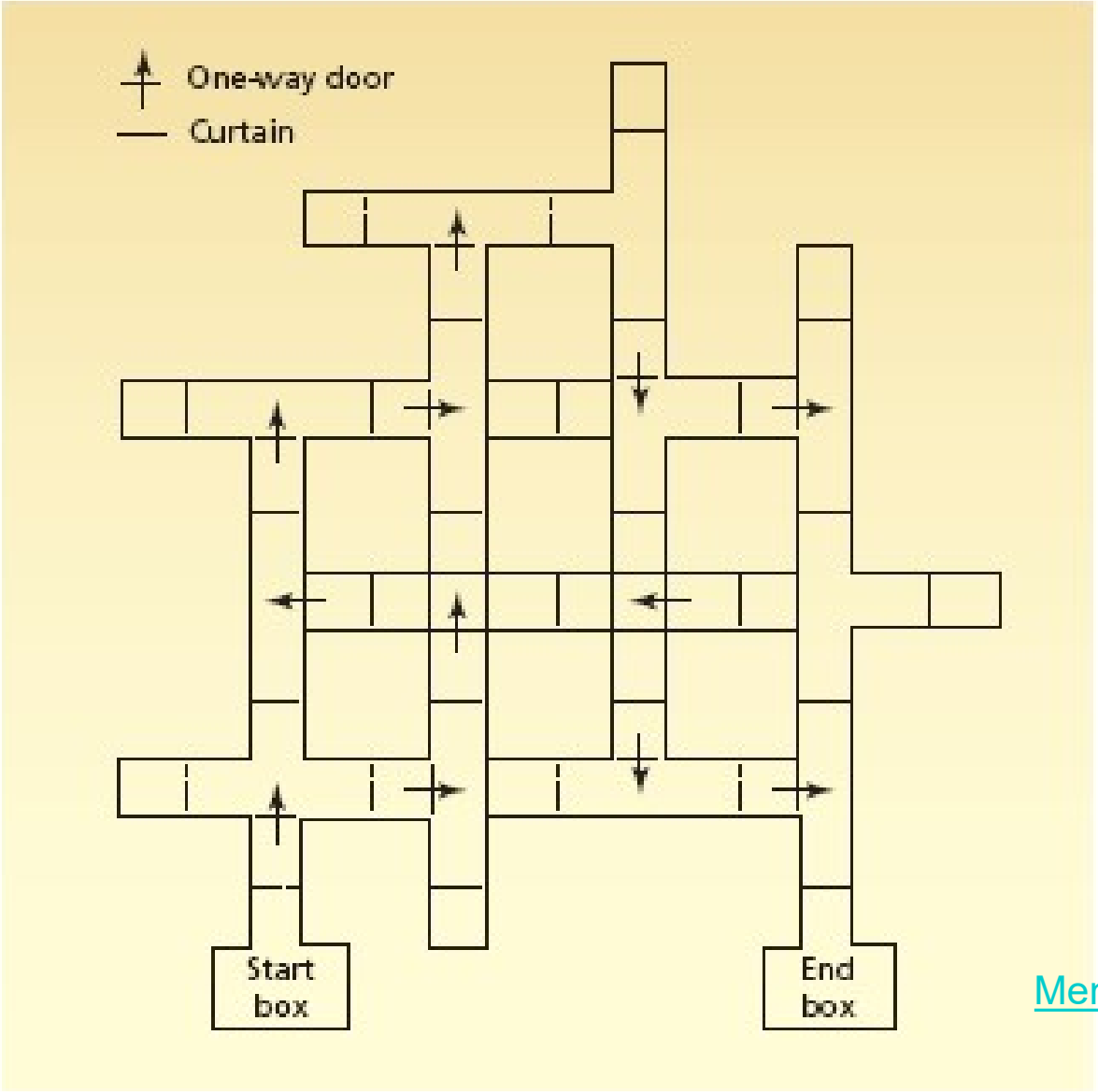

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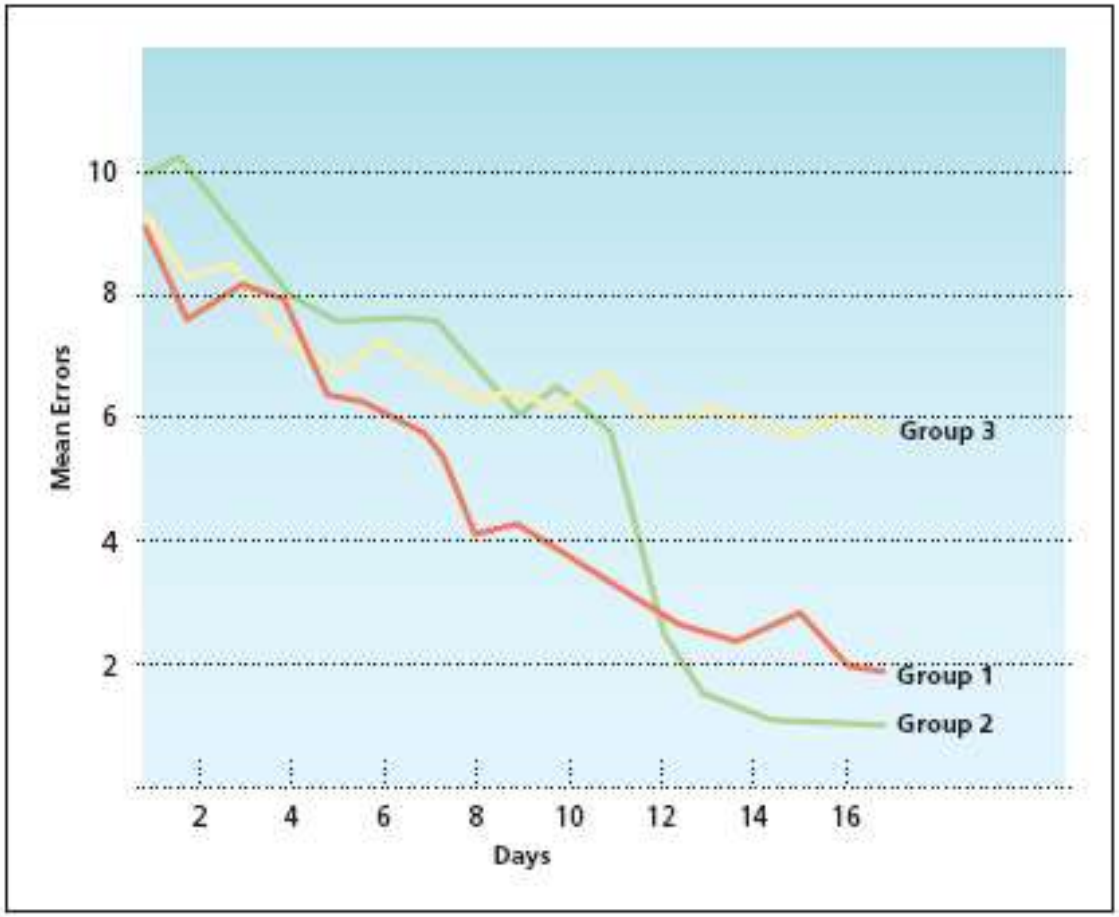
FIGURE 5.10 **Learning Curves for Three Groups of Rats** In the results of the classic study of latent learning Group 1 was rewarded on each day while Group 2 was rewarded for the first time on Day 11. Group 3 was never rewarded. Note the immediate change in the behavior of Group 2 on Day 12. (Tolman & Honzik, 1930)

LO 5.17 Tolman's classic study on latent learning



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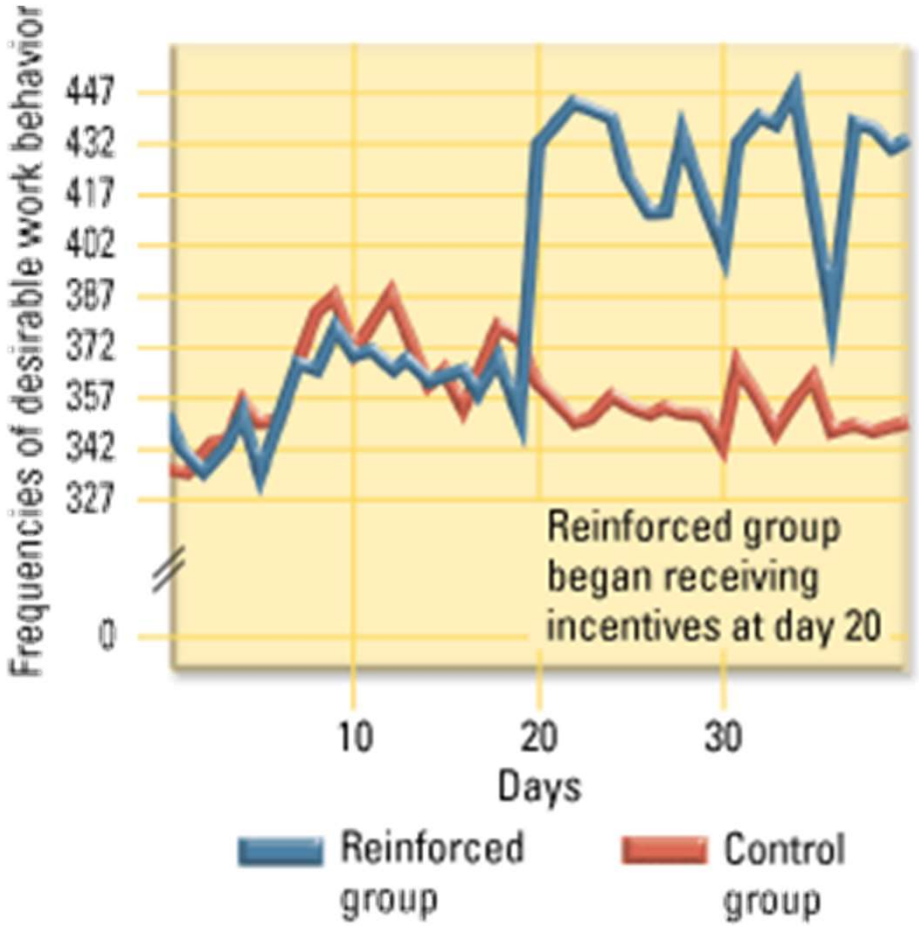
Another example of latent learning



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Learned Helplessness

- Learned helplessness - the tendency to fail to act to escape from a situation because of a history of repeated failures in the past.

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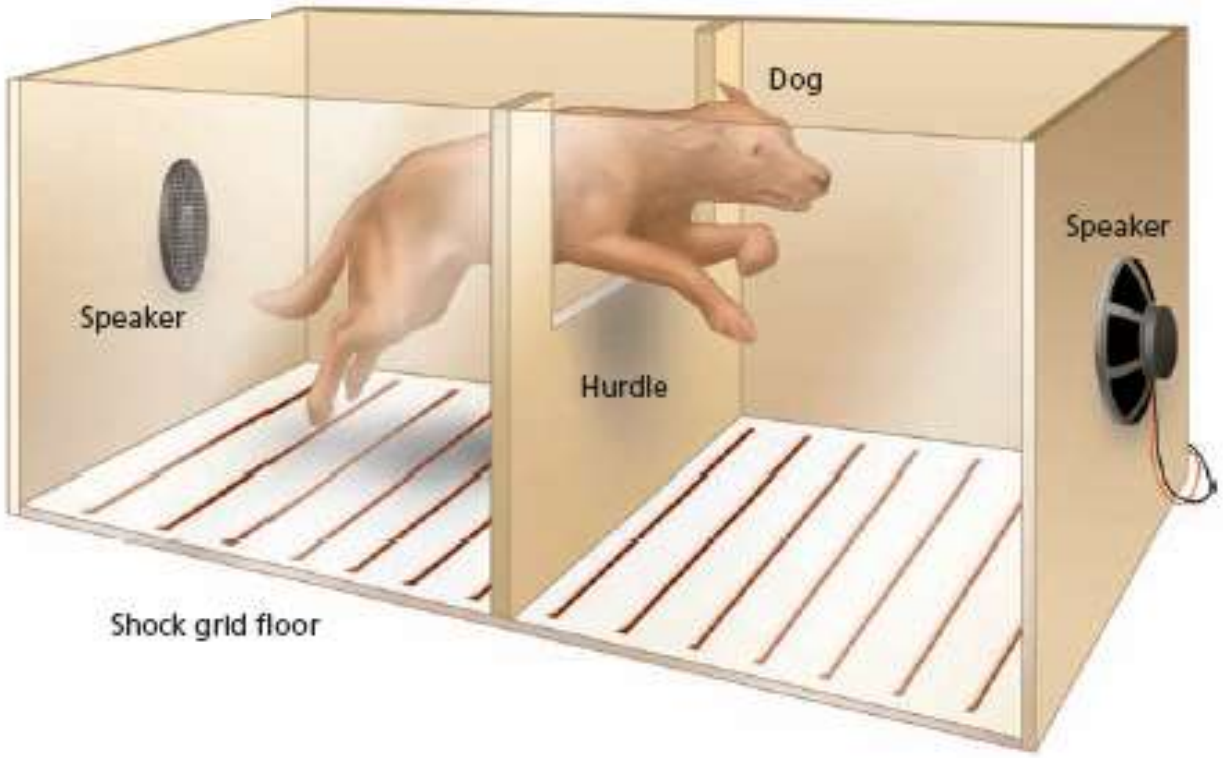
LO 5.18 Learned helplessness

FIGURE 5.11 **Seligman's Apparatus** In Seligman's studies of learned helplessness, dogs were placed in a two-sided box. Dogs that had no prior experience with being unable to escape a shock would quickly jump over the hurdle in the center of the box to land on the "safe" side. Dogs that had previously learned that escape was impossible would stay on the side of the box in which the shock occurred, not even trying to go over the hurdle.



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Insight

- Insight - the sudden perception of relationships among various parts of a problem, allowing the solution to the problem to come quickly.
  - Cannot be gained through trial-and-error learning alone.
  - “Aha” moment.

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Observational Learning

- Observational learning - learning new behavior by watching a model perform that behavior.
- Learning/performance distinction - referring to the observation that learning can take place without actual performance of the learned behavior.

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LO 5.21 Bandura's classic Bobo doll study

Albert Bandura's famous Bobo doll experiment. This doll was used to demonstrate the impact of observing an adult model performing aggressive behavior on the later aggressive behavior of children. The children in these photos are imitating the adult model's behavior even though they believe they are alone and are not being watched.

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Four Elements of Observational Learning

1. **ATTENTION**
   To learn anything through observation, the learner must first pay attention to the model.
2. **MEMORY**
   The learner must also be able to retain the memory of what was done, such as remembering the steps in preparing a dish that was first seen on a cooking show.
3. **IMITATION**
   The learner must be capable of reproducing, or imitating, the actions of the model.
4. **MOTIVATION**
   Finally, the learner must have the desire to perform the action.
   (An easy way to remember the four elements of modeling is to remember the letters AMIM, which stands for the first letters of each of the four elements).

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Real World Example

- Training a cat to use the toilet will involve:
  - Shaping.
  - Preparing “the training arena.”
  - Positive reinforcement on a variable schedule.

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